

MCF3M
Periodic Phenomena

Example 1: Consider a Ferris Wheel, with seat A located 1 m above the ground. As the Ferris Wheel turns, the height of seat A above the ground is recorded each second, until A returns to its original location 25 seconds later.

The graph (height vs. time) would be:

⇒ this is an example of a repeating function

Definitions:

- > sin function
 - is a self-repeating graph
 - formed by repeating data
- > period
 - the smallest complete repeating pattern
- > amplitude
 - the length of one cycle
- > axis of symmetry
 - the horizontal line that is halfway between the maximum and minimum values of a periodic function
- > equation of the axis of the curve
 - in the Ferris Wheel example
 - maximum value = 31
 - minimum value = 1
 - period = 25 (5s)

$$\frac{31+1}{2} = y = 11$$

amplitude = $\frac{31-1}{2} = 10$
 max - min = amplitude

$$\frac{31-1}{2} = \frac{30}{2} = 10$$

> amplitude

- the vertical distance from the axis of the curve to either the maximum or minimum value
- symbol a

$$\frac{\text{max} - \text{min}}{2}$$

Example 2: The water in Mathville Bay is shown on the following graph. Determine the period, amplitude, and axis of the curve.

Max 8 8+3 axis of symmetry = 5.5
 min 3 2 = 5.5 amplitude = 8-5.5 = 2.5
 period = 10-0 = 10 hours

Example 3: Sketch the periodic curve, over 3 cycles, given the amplitude = 4, period = 6, equation of the axis of the curve = 3.

Example 4: The Sun always shines on half the Moon. How much of the Moon we see depends on where it is in its orbit around Earth. The following table shows the proportion of the Moon that was visible from Southern Ontario on days 1 to 74 in the year 2006.

Day of Year	1	4	7	10	14	20	24	29	34	41	48	55	62	69	74
Proportion of Moon Visible	0.02	0.02	0.05	0.08	1.00	0.73	0.34	0.00	0.08	0.52	1.00	0.88	0.42	0.13	0.00

Create a graph using the Moon data.

Use the graph to answer the following questions:

- What proportion of the Moon was visible on day 130? *extrapolate*
- Was there a new Moon on day 59? When will the next two new Moons occur? *interpolate*
- In the first 74 days of 2006, how many times will 50% of the Moon be visible in the clear night sky?

Proportion of Moon Visible vs. Day of Year